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THE SCIENCE NEWS-LETTER

A Weekly Summary of Current Science

EDITED BY WATSON DAVIS

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EDWIN E. SLOSSON, Director
WATSON DAVIS, Managing Editor

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GRAVITY BALANCE MAY BE DIVINING ROD FOR OIL

Oil, liquid wealth, located beneath the ground without the risk and cost of drilling.

This has been the promise of a long list of fakirs who have victimized oil men who have been credulous in their eagerness to realize on the rosy promises to locate oil pools with absolute certainty, tell the depth to the oil, whether the wells would be pumpers or gushers and the amount of oil they would produce. "Doodlebugs" is the contemptuous name that has been won by the mysterious contraptions used by these fakirs.

Yet now comes a scientific instrument that promises to be a sort of divining rod for oil. It is the Eotvos Torsion Balance, now being tested by certain progressive oil companies in California as an aid in locating new oil fields.

This instrument was developed over thirty years ago by the great Hungarian physicist Eotvos who found he needed some super-sensetive means of measuring the force of gravity so as to detect its minute variations from place to place. However, it was a great many years later that the first suggestion was made that the balance could be put to practical use and it is only within the past few months that oil companies have become interested in its possibilities.

Essentially the menchanism consists of a light aluminum bar suspended from a fixed point by a fine platinum wire about a yard long. On one end of the bar is fastened a little platinum weight while an equal weight attached to the opposite end hangs down two or three feet below the bar. The weighted bar tends to rotate under the influence of the force of gravity until it comes to a certain position of equilibrium. This position of rest is either read off on the scale provided or in the case of newer models registered photographically. The whole instrument is then turned in another direction, the new position of rest recorded and the process repeated until enough data have been secured to calculate the exact value of the force of gravity at that atation. Similar observations are made at other stations judiciously spaced over the area being investigated.

The torsion balance gives no direct indications of the presence of oil-bearing rocks underground. It gives only an accuratepicture of the variations of the force of gravity in the locality. It is then up to the oil geologist to use this gravity data to help in working out the location of structures in the underlying rocks which are favorable for oil accumulation. Most of the important oil fields have been found to occur where the underlying strata have been arched upward. Where such conditions exist the older and generally heavier rocks approach nearer the surface and bring about a slight local increase in the force of gravity. It is in this roundabout manner that gravity measurements aid in the search for oil.

In actual practice a lot of troublesome corrections have to be made; for the force of gravity is influenced by distance from the equator, elevation above sea level and especially by the proximity of hills and mountains. The Torsion Balance is so sensitive that even the presence of the observer is registered by a deflection of the beam. It bears much the same relation in sensitivity to the delicate balance used in chemical analysis as that instrument does to the railroad scales used for weighing freight cars. Extraordinary precautions have to be taken to prevent disturbances other than those due to gravity. The swinging parts, consisting of wire, beam and weights, are enclosed in a double-walled metal case. Even then, the sun's rays might set up tiny air currents inside which would cause temporary deflections of the beam and so the observations are customarily made at night with the instrument housed in a tent with insulating walls.

Experiments are still in progress and commercial considerations make the oil companies reticent in disclosing the successes and failures of the new method for predicting oil.

SKY PINWHEELS ARE STELLAR UNIVERSES 6,000,000,000,000,000,000 MILES AWAY

The spiral nebulae in the sky are universes consisting of uncountable hosts of stars, at distances so inconceivably great from our own starry system that it takes light, traveling at the rate of 186,000 miles a second, over a million years to reach the earth. The astronomer who has completed this dizzying discovery is Dr. Edwin Hubble, of the Mt. Wilson Observatory in California, according to an announcement made by the Carnegie Institution of Washington.

Nebulae are the hazy areas of light common in the Milky Way, which may be seen also as isolated patches elsewhere in the sky. Some of these nebulae have a curious spiral outline, appearing in the telescope like vast Fourth-of-July pinwheels.

The question of the nature of the spiral nebulae is one of the most interesting problems of astronomy and has led to a marked divergance of opinion on the part of those who have studied them. Some astronomers have believed that they are at enormous distances from the earth and constitute independent stellar systems or "island universes", while others consider them as objects within our own stellar universe at distances comparable with those of our fainter stars. The number of spiral nebulae is very great, amounting to hundreds of thousands, and their apparent sizesrange from small objects almost star-like in character, to the great nebula in Andromeda which extends across an angle of some three degrees in the heavens, about six times the diameter of the full moon.

"The spiral nebulae are much too distant to admit of the use of the simple method of triangulation employed successfully in the case of the nearer stars," Dr. Hubble explains. "There are, however, powerful methods available which depend upon the possibility of determining directly the true or intrinsic brightness of stars from the characteristics of the light which they send to us. If the intrinsic brightness of a star is known, it is a very simple computation to derive its distance by comparison with its apparent brightness in the sky.

One of these methods and that employed by Dr. Hubble in his investigation of the two brightest spiral nebulae, depends upon the fact that certain stars which vary in light in a definite way are known to show a direct relationship between the period of their light variation and their true or intrinsic brightness. The method has been used successfully by Dr. Harlow Shapley of the Harvard College Observatory

in his studies of the distances of the globular star clusters and the Magellanic clouds of the southern hemisphere.

The investigations of Dr. Hubble were made photographically with the 60 inch and 100 inch reflectors of the Mount Wilson Observatory, the extreme faintness of the stars under examination making necessary the use of these great telescopes. The resolving power of these instruments breaks up the outer portions of the nebulae into swarms of stars which may be studied individually and compared with those in our own system. From an investigation of the photographs, 36 variable stars of type referred to, known as Cepheid variables, were discovered in the two spirals, Andromeda and No. 33 of Messier's great catalogue of nebulae. The study of the periods of these stars and the application of the relationship between length of period and instrinsic brightness at once provided the means of determining the distances of these objects.

The results are striking in their confirmation of the view that these spiral nebulae are distant stellar systems. They are found to be about 10 times as far away as the Small Magellanic Cloud, or at a distance of the order of 1,000,000 light-years. This means that light travelling at the rate of 186,000 miles a second has required 1,000,000 years to reach us from these nebulae, and that we are observing them by light which left them in the Pliocene age upon the earth. With a knowledge of the distances of these nebulae, we find for their diameters, 45,000 light-years for the Andromeda Nebula, and 15,000 light-years for Messier 33. These quantities, as well as the masses and densities of the systems, are quite comparable with the corresponding values for our local system of stars, the one in which the earth is but a mere speck.

"Although these nebulae are the most distant objects for which we have reliable data, it seems probable that many of the smaller spiral nebulae are still more remote and appear smaller on this account," Dr. Hubble concludes. "From this point of view the portion of the universe within the range of our investigation consists of vast numbers of stellar galaxies comparable to our own, scattered about through nearly empty space and separated from one another by distances of inconceivable magnitude."

NEW KIND OF IMMUNITY DISCOVERED BY CHICAGO SCIENTIST

A new method of combating disease germs has been discovered by Dr. H. W. Taliaferro, formerly of the Johns Hopkins University and now of the University of Chicago.

When dangerous bacteria invade the human body, the automatic defensive mechanism of the body usually throws fighting units, called antibodies, into the front line trenches of the blood. These protective substances kill the harmful disease organisms.

The new substance found by Dr. Taliaferro is related to such usual antibodies. But instead of wiping out the invading army of germs, it prevents it from perpetuating itself.

Working on a harmless blood parasite of rats, similar to the organism causing tropical sleeping sickness, Dr. Taliaferro found that the parasite, after an initial period of active multiplication apparently lost the power to reproduce its kind. Furthermore, by certain experimental precedure, he found that this peculiar occurrence is due to some substance produced in the rat's blood, and that blood serum

containing this substance could be used to stop reproduction of the parasites in new infections.

This seems to be an entirely new kind of "antibody" action. Generally, sera anti-toxins, and like substances act either by destroying the disease producing organisms or neutralizing their poisons. With this newly discovered substance, however, the case is different; it tolerates the existence of a few organisms, but literally forces race suicide on them by preventing them from multiplying.

It remains now to discover whether in human sleeping sickness a similar action exists or can be induced. This problem Dr. Taliaferro is attacking.

African sleeping sickness is due to a microscopic animal known as a trypanosome and is closely related to the organism found in rats' blood. There are two varieties of tropical sleeping sickness in Africa, the Gambian and the Rhodesian; and one variety in the tropical parts of South America. The Gambian variety of Africa is the more serious one. All of the tropical sleeping sicknesses are carried by insects, just as malaria and yellow fever are carried by mosquitoes.

Besides the tropical sleeping sickness, there is another entirely distinct disease in the temperate zone, called by the same name. This ailment, Encephalitis letnargica, which has been making some trouble in northern countries for some years, has never been traced to its cause, though it is probably due to an ultra-microscopic germ that can pass through the pores of the fine filter.

TREES FED AND CURED BY HYPODERMIC INJECTIONS

Hypodermic injections are being used to feed and cure hungry and ailing fruit trees at the University of California.

Dr. C. B. Lipman wields a glorified hypodermic needle-like apparatus with which curative solutions and food are placed directly into the circulation of the growing plant. The natural method of providing the tree with its sustenance through the soil by means of fertilizers has in a large measure been superseded by direct feeding and medical treatment.

Primarily the new method is being used as a first aid to sick citrus trees. Orange and lemon orchards are sometimes attacked by a disease called chlorosis which causes the leaves to become yellow and the trees to cease bearing fruit. Prof. Lipman and his associates attended some trees that had been in this nearly dormant condition for three years.

They bored holes into their trunks to about three-quarters the diameter. Then glass tubes were inserted and sealed tightly with a special wax. Reservoirs containing a solution of ferrous sulphate were attached and the trees were allowed to drink up the solution.

In three weeks the yellow leaves had been replaced by green ones and the trees had taken a new lease on life. They now give signs of fruiting.

Citrus trees are heavy users of calcium in which some soils are deficient and the University of California scientists have found that injection of calcium nitrate or chloride into their trunks will cure and prevent a harmful mottling of the leaves due to lack of this salt.

"We believe that this ushers in a new era in feeding plants," Prof. Lipman declared in commenting on the experiments that as yet have been reported only to the National Academy of Sciences. "We can ignore the soil completely and feed directly to the tree the nitrates, phosphates, calcium and magnesium salts necessary to its growth. Such direct injection of the nutrients allows us to avoid the troubles caused by the complexities of the various chemical reactions of the soil."

Although experiments have been performed on apricot, plum, lemon, orange and pear trees and on barley and wheat during the past two and a half years, no announcement of results has heretofore been made.

Trees can be pepped up as well as fed by the injections. Prof. Lipman says that calcium and potassium salts have a stimulating effect when injected. Large quantities of solutions can be absorbed by the trees. One pear tree was persuaded to soak up over 60 quarts of chemicals in 24 hours.

The insect menace is to be combated by the new injection method. Prof. Lipman plans to experiment with solutions of chemicals that are known to be toxic to injurious insects but not harmful to the trees. The trees injected with the poisonous liquid will become poisoned bait to marauding scale insects or other harmful pests and thus will become self-protective.

NOISE OF ELECTRONS HEARD BY HUMAN EARS

The smallest thing in the universe has made a noise and man has listened to it. Scientists have previously discovered and measured the electron but today Dr. A. W. Hull of the General Electric Company's research laboratory and Dr. N. H. Williams of the University of Michigan reported to the American Physical Society meeting that they have been successful in listening by radio to movements of electrons, the smallest particles of matter.

Using a vacuum tube radio amplifier, magnifying the sound a hundred thousand fold, the rain-like blows of many electrons on the plate of the tube produced a roar that sounded like Niagara in the distance. The sound is caused by bombardment of the plate by electrons, released from the hot filament. It is these electrons, which carry the current and which make the operation of the tube possible. Dr. Hull therefore believes the noise is a fundamental property of electron emission, a characteristic of the electron. The noise, due to the electrical oscillatic which is set up by the impacts of the individual electrons on the plate, is known as the Schrot effect and was predicted on theoretical grounds by Dr. Schottky of Berlin.

Listening to the electrons was merely incidental to more technical researches undertaken by Drs. Hull and Williams. They were primarily engaged in measuring the electrical charge on the electron.

This was first accomplished with great accuracy by Dr. R. A. Millikan of the California Institute of Technology at Pasadena and winner of the Nobel Prize for physics last year. Drs. Hull and Williams were attempting to obtain the same results by a method differing from that used by Dr. Millikan.

Dr. Millikan's method of measuring the charge of an electron is based on the influence of gravity and of electric charges on minute oil "droplets". These droplets are so small that the effect of gravity causes them to fall only a quarter of

an inch in ten seconds - they are about three hundred-thousandths of an inch in diameter and are observed in a powerful beam of light with a small telescope. They are then seen as specks of light against a dark background.

In the formation of these small drops with an atomizer, occasionally one becomes charged by friction; that is, it may carry an additional electron. If then the droplet is between two electrically charged plates it will behave differently from the uncharged particles, Dr. Hull stated. Those which are not charged will fall. The charged particles will be attracted to the positive plate. By the use of the proper voltage between the plates, these charged particles can be made to fall more slowly, held stationary, or caused to move upward. If two electrons, instead of one, are held by the droplet, the effect is doubled.

Doctors Hull and Williams have measured the charge of the electron in a different way, by means of the Schrot effect, and have opened a field for research whih which promises to add to the knowledge regarding the electron and its properties. Previous attempts were made by German scientists to make the electron audible, and to measure the charge of the electron by this method. Only approximate values were obtained, however. By the procedure used by Drs. Hull and Williams it is possible to obtain values of high accuracy. The measurements thus far made by this method give a value for the charge of the electron within one half per cent. of Dr. Millikan's value. The scientists made the measurements while working with radio frequencies and studying vacuum tubes.

Atoms have also been made audible within the past few weeks. It was recently announced that a device had been perfected in the research laboratory of the General Electric Company that reproduces in a radio loud speaker the rustle made by bringing a magnet close to a bar of iron and thus making groups of atoms atir themselves.

SCIENTISTS SEEK MEANS TO LIMIT TIMBER WASTE

This is the story of the House that Jack Didn't Build.

These are the woods where the trees used to grow that would have furnished th lumber for the house that Jack might have built. The woods are the areas of virgin timberland in the United States. They are two-thirds gone now. Of the original 681 million acres of forest in the eastern United States less than a tenth now remains uncut; the West fares better, but badly enough, for nearly half of its original 141 million acres also are gone.

Destruction recorded in such tremendous figures is engrossing the attention of the National Conference on the Utilization of Forest Products called by the U. S. Department of Agriculture. Representatives of federal and state governments, of the leading universities and forestry schools, and of the wood-using industries, are getting their heads together over the provlem of the House that Jack Didn't Build.

Not only is the ax eating fast and deep into our remaining woodlands; but it is accompanied and followed by waste, in a dozen devouring forms. Fire, decay, insect injury, all take their toll of the trees even before the woodsmen approach. How much, is not accurately known, but the losses are large.

Then when the woodsmen do come, the waste continues merrily. Department of Agriculture figures show an average of 28 per cent. of anygiven stand of timber

wasted in the cutting, as slash, stumps, rejected whole trees left to rot where they fall, etc. And when the 72 per cent. that goes out as logs gets to the mill another chapter in the story unfolds - perhaps the biggest waste item of all. For here each log yields only a trifle more than half its bulk as usable lumber. Some 47.4 per cent. goes to the blazing trash-heap of the mill, as bark, slabs, sawdust, and other refuse. Thus only a little more than one-third of the trees of an average forest area ever reach the lumber yard as beams and boards.

Further wastes occur in the lumber yard. Decay again creeps in, and losses due to careless handling and seasoning.

And so the story goes. Losses again in building the house. Losses in furnishing it - furniture factories shave off as waste as much as 60 to 75 per cent. of the wood they take in. Losses in keeping the house in repair; for there again the demon of decay gets in its deadly work. Losses through decay in fence posts, telephone poles, railway ties; government estimates show that 50 per cent. of each year's new stock in these three items must go to replace losses due to decay.

It is against this blind devourer, decay, that the main drive of the conference is made. Replacements through reforestation of denuded areas are necessarily slow. Protection against fire and other destruction of forests can only hold stationary what is there already. Immediate results must be sought through the stoppage of the leaks of waste and decay.

PIGS' RHEUMATISM CURED BY DOSE OF SUNLIGHT

Even pigs need the sun. Recently doctors proved that children who were allowed to play in the sunlight were not troubled with rickets, or malformation of the bones.

And now Dr. Harry Steenbock, E. S. Hart, and J. H. Jones of the University of Wisconsin have proved that sunshine is a preventative of the rickets, or rheumatism, common to hogs in northern states.

Dr. Steenbock in a series of experiments with rats had recently demonstrated that foods exposed to sunlight can be used as a cure for rickets. It remained to be determined whether or not exposing the pigs to sunlight would have the same effect.

Twenty-four pigs, reds and blacks, were used for the experiment. To discover whether it was the sunlight alone that prevented the disease they were divided into groups of six. Two of these groups were fed on yellow corn, which is rich in antirachitic vitamin, the other two were fed on white corn which contains less of the antirachitic vitamin.

Two of these groups were placed in "dark" pens and two in light. The "dark" pens could not be considered dark in the ordinary sense of the word, but the pigs in them were shielded from the direct rays of the sun. Both groups were placed in inside pens with outdoor runways. The outdoor runways of the pigs kept in the dark were roofed over with a composition roofing which kept off the direct rays of sun.

The range of the experiment was from June to January. The time is important as the intensity of ultra-violet solar radiation varies decidely with the season

of the year. Rickets occur in children most often in the seasons when the sunlight contains less of the ultra-violet rays.

As a criterion of progress the pigs were weighed every two weeks.

A great irregularity in growth was shown varying with the reserves of vitamin stored up by the animal from birth. It is impossible to produce rickets in any animal that has been long fed a ration rich in vitamin before the experiment. Dr. Steenbock concludes that ultra-violet light can substitute for the vitamin preventing rickets but not for the vitamin (A) which promotes growth, and that in spite of radiation, growth will cease on exhaustion of stored reserves of Vitamin A.

The yellow corn group grow better than the one on white corn. In the yellow corn group light was found to be extremely beneficial to the animals. Little by little, the pigs kept in the dark stiffened until they could hardly walk, even with extreme provocation.

On microscopic examination the bones of all pigs that lived in the light were seen to have a more regular structure and better arrangement of tissue than those that lived in the dark.

The experimenters conclude that "light in the absence of a sufficiency of the antirachitic vitamin is an important factor to consider in swine industry. In fact, there remains no question, in view of the conditions under which pigs are generally kept and fed in northern climes, that more attention should be paid to illumination.

EASY TRANSPORTATION CAUSE OF DISAPPEARING FORESTS

America's far-flung transportation system has been one of the main causes of forest depletion, and may be turned into its principal cure, according to William B. Greeley, chief of the United States Forest Service, and chairman of the National Conference on Utilization of Forest Products.

"It is worth pointing out that the United States is the first country where the exhaustion of timber in one section could be readily met by the cutting of forests 2000 miles distant," he said. "Our transportation system has largely concealed the ultimate outcome of the exhaustion of old growth timber.

"This marvelous tool of transportation ought to be employed with equal effectiveness in carrying out the economies now forced upon us. It ought to make a local surplus of waste timber or inferior woods nationally available.

"An official of an important New England railroad recently proposed that low grades of lumber be given lower freight rates in order that the railways may get the benefit of the traffic. If this proposal is sound from the standpoint of the railroad, it is doubly sound from the standpoint of timber conservation."

Mr. Greely also re-emphasized the importance of preventable decay. "Preventable decay probably destroys enough wood annually in the United States to build a city for a million people," he said.

FRENCH AUTO TRUCKS GENERATE OWN GAS

The high cost of gasoline is driving French firms operating large fleets of trucks and busses to seek other types of fuel. One response to this need has been the development of portable gas plants using such materials as powdered coal, sawdust and powdered charcoal for the production of a gaseous fuel which may be used instead of the costly liquid kinds.

One or two types of "gazogene", as the new apparatus is called, utilize low grade gasoline and crack it by heat, but the majority of them use the powdered solids. So far no type of "gazogene" has been evolved suitable for pleasure cars, for the apparatus is comparatively bulky and has no more beauty about it than an old-fashioned airtight stove; but for the larger vehicles its use is becoming increasingly popular. About seventeen firms have placed "gazogene" models on the market.

RESEARCH OF PYORRHEA SUPPORTED BY CARNEGIE CORPORATION

If anything can be done by science to save our natural teeth from being replaced by better looking ones made by the dentist, it is likely to be found out in the next five years at the University of California, for that institution has received a fund of $105,000 for a thorough investigation of pyorrhea and its relation to other human maladies, to be carried out by the joint cooperation of experts from various fields of science. Of this sum $85,000 comes from the Carnegie Corporation of New York.

Besides this new field of somatological research the annual report of the Carnegie Corporation issued announces the continuace of the support of investigations of insulin. This hormone has already come into general use as a remedy for diabetes and has perceptibly reduced the death rate. New grants of $10,000 each are made to the California Institute of Technology, Pasadena, and to the University of Alberta, Canada, for research on insulin. Besides these the University of Toronto receives $8,000 and the Potter Metabolic Clinic $15,000 for insulin work.

SIAMESE FIGHTING FISH VISIT LONDON ZOO

One of the latest curiosities to arrive at the London Zoological Gardens is a pair of fighting fish from Siam.

Normally this fish is quite dull in color, but when another male of the species draws near, its body suddenly glows with the most brilliant metallic colors mingled with scarlet, purple, and gold. The two males fight desperately until one or other gains the victory. The conqueror then parades up and down in all his gorgeous war panoply, which only gradually changes back to the original drab color.

In Siam the breeding of fighting fish is an important industry, and large bets are made on the result of fights, conducted under rules as stringent as those of cock fighting. It is not often that a fish comes twice into the arena because even if victorious he is usually so seriously damaged as to be unfit to fight again.

TIDAL POWER STATION UNDER WAY IN FRANCE

What is believed to be the world's first tidal power station is in process of construction at Aberwrack, north of Brest. Due to the tidal variation at this point the power will not be constant. The present plan is to use it for the operation of an electro-chemical factory.

This experiment will be watched with especial interest because of the recently proposed American exploit of harnessing the tides of the Bay of Fundy.

OLDEST BEETLE FOSSIL FOUND IN NORTH CHINA

A scarab beethle of an age that makes King Tut's reign a mere tick of the watch ago, has been turned up in that most venerable land of old things, China. H. C. T'an, of the Chinese Geological Survey, working in Shantung, the sacred province of north China, found the fossil beetle in rocks of the Cretaceous period, or Age of Fishes, of an age estimated at fifteen million years. This makes the scarab easily the oldest beetle in the world. Evidently the genus has been very conservative in the matter of evolution, for this primitive scarab resembles very closely his present-day n-th degree great-grandchildren. He has been named Proteroscarabaeus or "earliest scarab."

SPECIAL THERMOMETERS TELL WHEN ORANGES ARE COLD

Fruit thermometers, similar to those used by the doctors, are being employed by the fruit growers of Southern California in order that they may know when the oranges are chilly. They are inserted insmall openings in the skin of the orange and warn the grower of approaching freezes.

Twenty-seven degrees F. is the danger point for oranges, and the fruit thermometer makes it possible for the grove owner to start his heating plant in time to save his fruit. Otherwise, depending on ordinary sheltered thermometers he might start it too soon and lose by operating unnecessarily long hours. Or, being a thrifty soul, he might delay operations and lose his crop.

Loss by frost in 1924 was unusually small due to the fact that there was very little rain, and the trees were heavily mulched with bean straw. The frost-loss was particularly great in 1923, due to a heavy freeze following mild weather.

More than 8,000,000 cattle are under supervision for the eradication of tuberculosis.

Methane gas may be collected from garbage and used for heating and lighting.

All cotton grown by the experiment station of the Lousisiana State University is to be marketed cooperatively.